ITS4C Congress
Smart Mobility for Climate
17 - 19 September 2019

Decarbonisation Toolbox
WORKSHOP 4

4 Decarbonising Freight and Logistics

The ITS for Climate initiative (ITS4C) was established in 2015 during the ITS world Congress held in Bordeaux, under the leadership of the Nouvelle-Aquitaine Region in France to highlight the potential contribution to the reduction of CO_2 emissions of Intelligent Transportation Systems (ITS) and smart mobility innovations. In 2019, 32 Climate and Mobility experts set out to provide a “Decarbonization Toolbox» for cities, regions, national governments as well as for the ITS community and all stakeholders in the transport & mobility sector. This work was presented during the ITS4Climate Congress in Bordeaux.

www.its4climate.eu

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Highlights

Introduction

This topic covers the domain of ITS and smart mobility tools and measures for goods transport and logistics. Other expert groups are highlighting the effectiveness of advanced technologies for low-carbon vehicles, traffic networks, public transport and mobility as a service (MaaS).

Backbone of the modern economy

We live in exciting times, with rapid technological developments creating new opportunities that have emerged permitting business leaders to provide better quality of life and whilst reducing CO_2 emissions. As the world's population is increasing in number, garnering greater wealth and cities are rapidly expanding solutions are urgently needed. Solutions that meet challenges associated with ensuring delivery of product, removal of waste and logistics infrastructure development is all undertaken at pace whilst ensuring CO_2 emissions are kept to bare minimum.

As such, freight transportation and logistics are vital drivers of economic activity with Europe's road freight sector likely to see dramatic change in the decades to come. The sector [freight & logistics] is growing quickly, with the global market for trucks of 6 tonnes and over predicted to increase from €150 billion in 2015 to €240 billion in 2025. Furthermore, trucks also account for 40 per cent of the predicted growth in oil demand up to 2040, and as such are a target for governments and manufacturers who need to decarbonise.

Decarbonising goods transport

However, there are some simple ways in which the sector can reduce costs and carbon emissions, for instance through improved drivetrain efficiency, low-emission motorisation, aerodynamic refits, low-rolling-resistance tyres, reduced idling and lightweight materials, and lower-carbon fuels. As this congress will explore, the deployment of connected ITS and smart mobility can also be an important part of the solution.

All these challenges related to freight and logistics carbon can also be opportunities for European businesses, NGOs and Governments alike. Current electric batteries utilised to power many alternative fuel vehicles do not yet have a long enough range, although Tesla is among companies aiming to launch viable electric trucks. Some companies are also looking at rail or waterway alternatives, avoiding road freight altogether. Shorter-range operations are fertile ground for EV adoption, as illustrated by La Poste in France, which is converting much of its fleet to electric power.

For reasons of economy, autonomous vehicle technology is of great interest to the freight and logistics industry, as driver costs account for 30 - 60 per cent of total costs in the EU and there are significant labour shortages within the logistics sector. Recent 'platooning' road tests in Europe and the US have tested the viability of a convoy of trucks, led by a single manned vehicle, which also saves money by reducing wind resistance.

Goods vehicle pollutant and CO_2 emissions represent an external cost on society, some or all of which may be recovered via highway tolls or other charges, such as vehicle registration fees. Toll-highway operators and national taxation authorities thus have an important role to play in reducing emissions.

Policymakers can support such innovation and help balance several factors including environmental sustainability, public safety, competitiveness, and incentives to develop new technologies. However, the difficulty of this balancing act was recently illustrated by multi-billion EUR European Commission fines for a cartel of six European truck makers, for fixing prices and evading stricter pollution rules.

Introduction

Data-driven technologies will have a big impact on the road freight and logistics industries. For instance, telematics systems can use GPS data to optimise journeys and regulate driving behaviour, especially in the 'last mile' where loads need to be split into smaller units for delivery to different locations, often unsuitable for larger vehicles.

Technology based on the sharing economy can also help, for example using smartphone apps to employ freelancers for 'last mile' deliveries (although attitudes of policymakers towards new forms of irregular employment will impact this). App-based projects are being trialled that match companies who need freight services with spare capacity in others' vehicles. Such projects reduce carbon emissions, as well as saving costs.

There are opportunities to make Europe's freight and logistics sector much more sustainable and agile enough to compete in the global marketplace. Enhanced connectivity through ICT could significantly increase efficiency while reducing congestion, emissions, and resource consumption. Innovative technologies like electric vehicles and driverless transportation could make personal mobility more sustainable and efficient. In addition, intermodal transportation and vehicle sharing could help reduce congestion and miles travelled. Through the Internet of Things, any product, vehicle or load unit can be connected to another, creating a system that enables products to be transported in the safest and most efficient way.

The European Commission (2016) communicated a proposal for a European Strategy for Low-Emission Mobility, outlining that the transport sector plays a key role in air pollution in Europe : **Transport represents almost a quarter of Europe's greenhouse gas emissions and is the main cause of air pollution in cities.** Road transport is the largest source of nitrogen oxide (39%) and an important source of particulate matter (13%).
Transport in the EU still depends on oil for about 94% of its energy needs, which is much higher than in any other sector and makes transport heavily dependent on imports.

Emissions from lorries, buses and coaches currently represent around a quarter of road transport carbon dioxide emissions and are set to increase by up to 10% between 2010 and 2030. The EC report mentioned above states that the transport industry at large employs more than 15 million people, accounting for 7% of total employment in the EU34.
Urban transport is responsible for 23% of EU's greenhouse gas emissions. At world scale, CO_2 emissions in the transport sector are about 30% for developed countries and about 23% of total man-made CO_2 emissions worldwide. There is widespread agreement on the need to reduce CO_2 emissions from transport by a minimum of 50% at the latest by 2050.

This reduction will be attained by :

• **Now,** CO_2 emission standards are proposed for large lorries (logistics), which account for 65% to 70% of all CO2 emissions from heavy-duty vehicles.

• **2022,** the scope will be extended to include other vehicle types such as smaller lorries, buses, coaches and trailers.

• **2025,** the average CO_2 emissions of new heavy-duty vehicles will have to be 15% lower compared to 2019. This target is mandatory and can be achieved using technologies that are already available on the market.

• **2030,** emissions have to be at least 30% lower. This target is aspirational, giving long-term direction. It will be reviewed in 2022 to incorporate additional information on the new technologies needed to meet this target.

Achieving a one-third reduction in the goods transport sector's emissions over the next 10 years is indeed very challenging, especially when the sector is still growing and new emission standards take many years to reach full implementation of the vehicle parc. It will require full deployment of all effective measures. In the sections below we discuss the main technologies, tools and measures available to decarbonise the sector.

Introduction

ICT tools for low-carbon logistics

There is much talk across business sectors pertaining to Smart Mobility, and with specific focus on the Logistics sectors there are three key themes :

Traffic Management & Optimization is facilitated through connected smart sensors, location-based applications and intelligent infrastructure, all working together to make traffic, driving, loading/unloading and parking more efficient. Emission-related and non-stop tolling, can reduce emissions, as can intelligent truck parking.

Smart, Connected & Clean Vehicles means connecting people, infrastructure and lower-carbon vehicles. For example, mobile applications can enable truck-sharing or truck-pooling platforms and help organise trans-shipment to zero-carbon distribution services. Real-time information can also influence route choice and driver behaviour towards lower-carbon choices.

Smart Logistics is about connecting vehicles, products and load units, thereby improving route and load optimization and reducing the amount of waste in the system.

Smart Mobility and Logistics Solutions will be an important part of the solution to global mobility challenges. The ICT solutions that will optimize private mobility, traffic control and logistics, for example, are also likely to have a disruptive effect on the industry, challenging incumbents to change their ways while new actors play a growing role.
According to Gartner and Accenture Strategy research published in 2018, the role of disruptive ICT in transportation will mature in about a decade. While the common use of less advanced technologies like location sensing was likely to be commercially viable by now, while complex solutions like public telematics, connected infrastructure and connected or driverless vehicles might be widely available within a decade.
Alongside smart goods transport, smart logistics can be further characterised as follows :

Table 1 - CO_2 emissions and load factor improvements potential
Source: WWF, 2018

	2005 emissions light and heavy duty trucks MtCO2e	2030 baseline emissions light and heavy duty trucks MtCO2e	% improvement in total load factor			Net Emission reductions from total load factor improvement MtC02		
			low	Medium	high	Low	medium	high
OECD North America	370	504	5%	15%	30%	20	59	118
OECD Europe	282	374	5%	15%	30%	14	43	86
OECD Pacific	87	120	5%	15%	30%	2	7	14
FSU	46	79	5%	15%	30%	2	6	13
Eastern Europe	12	22	5%	15%	30%	1	2	5
China	59	153	5%	15%	30%	4	11	22
Other Asia	130	274	5%	15%	30%	9	27	54
India	56	145	5%	15%	30%	5	14	28
Middle East	130	204	5%	15%	30%	4	13	26
Latin America	154	272	5%	15%	30%	8	24	47
Africa	39	80	5%	15%	30%	2	6	13
Total	1366	2,226				71	213	426

Introduction

Smart logistics and goods transport

Smart Logistics are the improvements leveraged from ICT that result in an optimisation of distribution activities, reduction in distance travelled etc.
Carbon reduced through decrease in air, train, maritime and road freight through maximisation of vehicle capacity and logistics sharing.

Traffic optimisation

Traffic Control and Optimisation seeks to manage traffic and parking in cities in a smarter, efficient and more fluent way, through intelligent sensors and connected cars. (This is discussed in more detail in Topic 3 Briefing Paper.)
Carbon is reduced through increased use of efficient routes (reduced distance driven), increased efficiency of personal vehicles, and increased use of public transport.

ICT use within vehicles and transport

The analysis of potential benefits arising from a broader use of ICT within transportation infrastructures highlight a variety of areas with opportunities to improve efficiency and reduce GHG emissions.

For example, within vehicles ICT can be deployed to:

- **Improve efficiency of vehicle engines** (e.g. direct injection enabled by improvements in valve control may increase efficiency by 18%).
- **Monitor operating conditions of car components with aerodynamic impact** (e.g. using sensor technologies to maintaining tires in optimal conditions can reduce emissions by 3%).
- **Enable driving conditions that minimize energy use** (eco-driving), which are estimated to improve efficiency by 5% to 20%.
- **Provide drivers with real time information about their fuel use**, which has been shown to lead to changes in driving styles and on a reduction in fuel used.
- **Better run and monitor air conditioning systems** (e.g. to signal possible risks of leaks of gasses with high global warming potential).
- **Facilitate the design of vehicles that use lighter materials or benefit from improved aerodynamics** (weight and aerodynamics are, with engine efficiency, the largest drivers for vehicle emissions).

The potential for efficiency and GHG emission reduction associated with GPS fleet management and intelligent transport systems have been mostly analysed through individual case studies or research projects. With these ICT solutions, more than with any other transportation solution discussed in this section, analysts debate the risks of traffic (and GHG emissions) increase, due to latent demand from people who decide to travel as congestion decreases and travelling becomes easier and more enjoyable.
A critical factor is likely to be how successful these solutions are at enabling a migration from more polluting to fewer polluting forms of transportation (e.g. from private transportation to public transportation). For these technologies more than others, therefore, the policy conditions under which ICT is deployed will play a critical role in the achievement of possible GHG emissions benefits. This can for example be achieved with a combination of technologies that increase the convenience of public transportation while ensuring that private vehicles pay the full cost.
Fleet management systems are also important for freight transportation and associated emissions. For example, past research has highlighted that in developed countries at any given time 20 to 30% of all trucks on the road are circulating empty, while load factors may be in the order of 50%. The situation may be even more extreme in some developing countries. Inefficient route planning may also add additional unnecessary kilometres to each delivery and the consequent GHG emissions.
The analysis below highlights the potential for GHG emissions reductions from truck transportation, assuming ICT-enabled improvements in load factors. Efficiency improvements of 5%, 15% and 30% (to reach total load factors of

52.5%, 57.5% and 65% assuming a baseline load factor or 50%) would generate GHG emission reductions for 71, 213 and 426 MtCo2e respectively.

Sustainability aspects of smart mobility & logistics

The transition to smart, sustainable mobility brings a number of sustainability benefits. Efficient public and intermodal transport systems save commuters' time, generate economic benefits, and reduce emissions. For example, Mexico City is estimated to recover $141 million in economic productivity from just one of six lines of its Metrobús BRT system.
Our research shows that the emissions savings from the three use cases analysed, comprising Connected Private Transportation, Traffic Control & Optimization and Smart Logistics could abate 2.6Gt CO2e, repre- senting 21.5% of total ICT-enabled abatement potential by 2030. Furthermore, if we consider the reduced need to travel arising from changing practices across other sectors such as health, learning, work and commerce we can add another 1.0Gt CO2e emissions reduction from the mobility sector.

The US, China and India are the countries with the highest abatement potential for traffic control & optimization, with China accounting for almost 50% of the abatement potential for Smart Logistics.

ICT-enabled mobility solutions provide significant benefits, as illustrated here:

• **750 billion litres of fuel savings:** 236 billion litres of fuel could be saved in 2030 through traffic control and optimization, and 220 billion litres of fuel through connected private transportation. By 2030, smart logistics solutions could generate savings of 267 billion litres of fuel and 3.8 billion kg of wood.

• **$1 trillion of avoided costs:** in economic terms, traffic control and optimization could translate into $409 billion of avoided costs and connected private transport to around $611 billion of avoided costs. Various smart logistics processes and methods could also add an additional value of around $174 billion by 2030 to the economy as a whole.

• **Around 42 billion hours saved in 2030:** efficient traffic management solutions and high-quality navigation systems could save around 42 billion hours by 2030. As a result of car sharing, 135 million cars could be taken of the road by 2030. And for society at large, the various Smart Logistics solutions we have modelled could significantly reduce negative externalities like noise, traffic congestion, and health and safety risks, leading to a safer, cleaner and more peaceful urban environment.

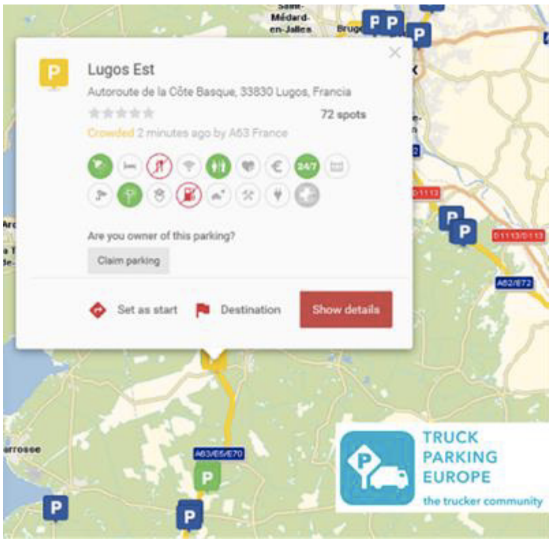
Examples logistics ICT for Carbon reduction

Example innovations & good practices

Smart highways : the A63 in Nouvelle-Aquitaine

The French A63 motorway from Bordeaux to the Spanish border is a showcase and testbed for new technologies, and which has a strong environmental mission. Four innovative measures can or are expected to help reduce CO_2 emissions.

• The strongest effect has already been produced, by variable toll charges, where a Euro 6 category heavy goods vehicle (HGV) pays 12,5% less than those of less clean categories. Between January 2015 and June 2019, the proportion of Euro 6 vehicles increased from 11% to almost 70% of journeys.
For the period 2014 – 2016, while the volume of trucks increased by 10% the emissions of CO_2 decreased by 24%. Additional reductions may occur should toll charges be reduced further for trucks fuelled by natural gas (compressed or liquid), as is planned by the Region.



• The application **"Truck Parking Europe"** includes real-time information on truck parking availability for 1200 spaces along 104 km of the A63. This is important for a road with 9000 HGV journeys per day, accounting for 30-50% of all traffic. This information is presented both by variable message signs alongside the highway and via Internet and the smartphone app "Truck Parking Europe" (TPE) of supplier PTV.
This service has reduced the chance that an HGV gets stuck in congestion at service areas, with corresponding reduction in pollution and CO_2 emissions. The TPE app advises the driver well before arriving at the next service area, so they can best plan their stop.

• **A traffic information service using** "cooperative ITS" was implemented in Bordeaux metropolitan area and along the A63, during the EU-funded project "C-The Difference" ending in 2018. For Bordeaux, a smartphone application was developed for drivers that used data from the traffic control centre to show traffic light status and recommend an approach speed to avoid stopping at the next lights. For HGVs, this leads to a significant reduction in emissions.
The same app shows drivers an image of all the variable message signs along the A63 and the Bordeaux orbital highway. This allows drivers to exit before problems ahead, and to prepare early before arriving at a congested zone.

• As part of a regional programme for a "living lab" of intelligent mobility services, **a trial of truck platooning** is planned to start by late 2019 or early 2020. On the A63, some 89000 pairs of trucks of the same operator per year pass with less than 1-minute headway. In this trial, one or more automated HGVs (without driver) would be attached to a lead truck (with driver), via an "electronic towbar". The following trucks would use less fuel due to better aerodynamics and need fewer drivers, so lower operating costs. The connected trucks would also take up less road space.

Examples logistics ICT for Carbon reduction

German states pave the way for truck electrification with new eHighways

With transport contributing toward roughly 25% of CO_2 emissions in the European Union, and heavy- duty vehicles accounting for one-fifth of these, electrifying truck transport is a key step to decarbonizing the economy. Electric trucks can also significantly reduce noise, allowing more overnight transport assignments, thus reducing daytime traffic. The benefits on public health due to the drastic reduction of air pollution, which will be particularly noticeable around metropolitan areas, is another obvious benefit.

Two alternative systems are available to electrify truck transport: **on-board storage** (the truck is powered by alternative fuel or electricity stored on board) **or external power supply** (the electricity is provided to the truck through an external system). This includes overhead catenaries (also known as overhead lines), (see box 'The technology side'), which are estimated to be the cheapest and most energy efficient option to electrify transport, according to preliminary data from the Öko-Institut.

In 2016, the federal Ministry of Environment issued a call for proposals for German states to build pilot eHighways using the overhead catenary technology.

The State of the Hesse was the first to start the process for the implementation of a 10.4km- eHighway pilot project coordinated by Hessen Mobil, the road and traffic management agency, together with the Technical University of Darmstadt. The project's budget amounted to €15 million. A few months later, it was followed by the state of Schleswig-Holstein, who collaborated with the regional Transport Ministry and Kiel University of Applied Sciences on a 10.1km eHighway project, which cost €19 million.

The State of Baden-Württemberg is also implementing a similar project on a national road.

Expected results and next steps

There are approximately 12,000 kilometres of highways in Germany, but because 60% of the emissions from heavy duty vehicles occur on 2% of the network, even electrifying only the busiest roads would make a huge contribution to emissions reduction. In addition, the application of overhead catenaries technology could be a lot broader than truck transport and include shuttle and mine transport, as well as long-haul traffic.

The construction phase is set to be completed by Autumn 2018 in Hesse and Spring 2019 in Schleswig-Holstein. The testing phase will then start, with up to five trucks provided by the federal government to each state. The trucks will be used by private transport companies for their daily business, transporting goods ranging from food products to paint. This provides the opportunity to test the logistical challenges of these new types of trucks in real traffic conditions.

After the completion of the test phase, which includes analysis of acceptance as well as investigations into lane and speed behaviour, a technological, ecological and economic evaluation of the system will be carried out. This will provide information on the benefits and potential expansion of the eHighways. Respective partner universities will perform this work.
An additional incentive for adoption should be in effect by 2019, when electric trucks will become exempt from truck tolls.

Building permissions : approval processes for building such infrastructure are typically quite lengthy (up to 5 years). However, due to the reduced timeline available to use the budget (approx. 2 years), the government of Hesse significantly sped up the process of establishing building rights for electric power lines, while complying with stringent environment laws. Importantly, this was only possible as the eHighways were pilot projects – the approval process for bigger scale projects will inevitably be longer.

Examples logistics ICT for Carbon reduction

Knowledge and capacity building: building eHighways requires a distinct skillset and expertise (for example, on infrastructure and technology). In the case of Hesse, the regional government tapped into both municipality expertise from cities experienced in running trams, and knowledge from the private sector stakeholders involved in the project. Those skills will also be key in maintaining the new infrastructure.

Environmental concerns: building the eHighways involves setting masts and catenaries, which may affect local biodiversity. Including these risks in the long-term planning of the project and establishing a dialogue with all stakeholders, such as local NGOs, was key in making sure the concerns were appropriately assessed and addressed.

Supra-national and European integration : these pilot projects must demonstrate reliability and eventually be rolled out across the European Union so that trucks travelling between member states are adequately equipped to use eHighways. Siemens Mobility, the project developer in both states, estimates that a 40-tonne truck driving 100,000 km on an eHighway could offer savings of up to €20,000 in fuel. If 30% of German truck traffic makes the switch to clean electric power, CO2 emissions could be reduced by six million tonnes. Electric trucks are also twice as efficient than traditional engines, which would significantly reduce local air pollution and operating costs.

European Logistics & fuel choice – climate action

On 17 May 2018, the European Commission presented a legislative proposal setting the first ever CO_2 emission standards for heavy-duty vehicles in the EU.

Expected benefits include :

• Around 54 million tonnes of CO_2 reduced in the period 2020 to 2030 – equivalent to the total annual emissions of Sweden.
• Savings at the pump amounting to around €25 000 in the first 5 years of use for a new lorry bought in 2025 and up to about €55 000 in the first 5 years of use for a new lorry bought in 2030.
• Oil savings of up to 170 million tonnes of oil over the period 2020 to 2040 – worth around €95 billion at today's prices.
• GDP increases resulting in the creation of around 25 000 new jobs in 2025.
The proposed targets for average CO_2 emissions from new lorries :
• In 2025, 15% lower than in 2019
• In 2030, at least 30 % lower than in 2019 (indicative target, subject to review in 2022)

As a first step, the CO_2 emission standards are proposed for large lorries, which account for 65% to 70% of all CO_2 emissions from heavy-duty vehicles.

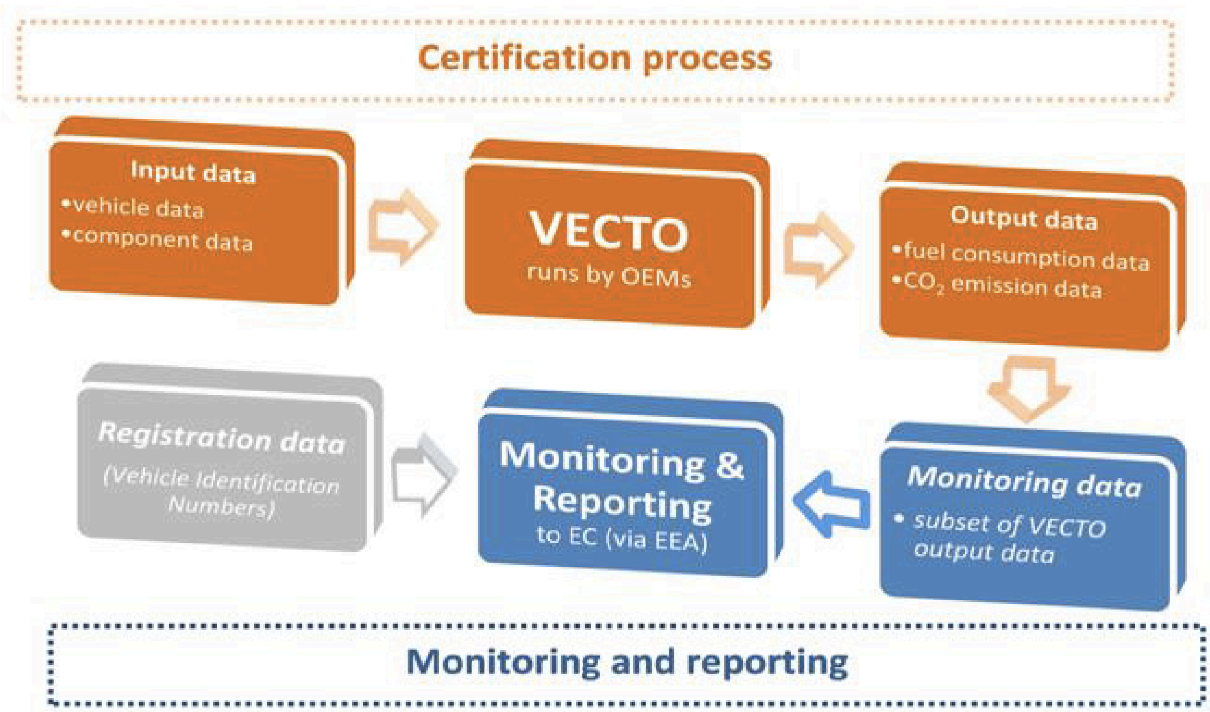
In 2022, the scope will be extended to include other vehicle types such as smaller lorries, buses, coaches and trailers.
The proposal also includes a mechanism to incentivise the uptake of zero- and low-emission vehicles, in a technology-neutral way. Today, about 98% of our lorries rely on diesel. There are virtually no large zero emission lorries on European roads, and few zero emission buses in cities. At the same time, almost all manufacturers have announced plans for zero emission vehicles. The Commission proposes to support these technologies and foster innovation through an incentive system which complements the Action Plan on batteries. This system of super credits will reward those manufacturers who will invest more in innovative technologies, while preserving the environmental integrity of the CO_2 targets. It also includes zero-emission buses which are needed for cleaner air in cities.

However, this strategy for zero emission vehicles has intrinsic issues associated mainly with cost, which can be dealt with through cost-effective implementation as follows:
Banking and borrowing to take account of long production cycles, including a reward for early action, while maintaining the environmental integrity of the targets. Full flexibility for manufacturers to balance emissions between the different groups of vehicles within their portfolio. Vocational vehicles, such as garbage trucks and construction vehicles, are exempted due to their limited potential for cost-efficient CO_2 reduction.

Examples logistics ICT for Carbon reduction

The VECTO tool

The information required for monitoring and reporting will be calculated using the Vehicle Energy Consumption Calculation Tool (VECTO).
VECTO is a simulation software that can be used cost-efficiently and reliably **to measure the CO_2 emissions and fuel consumption of high duty vehicles for specific loads, fuels and mission profiles** (e.g. long haul, regional delivery, urban delivery, etc.), based on input data from relevant vehicle components.
The tool has been developed by the Commission in close cooperation with stakeholders. For more information on VECTO, see Annex 12 of the impact assessment.



Examples logistics ICT for Carbon reduction

TNO SR9 impact assessment project

The Service Request 9 (SR9) project is aimed at providing support to the European Commission for the preparation of an impact assessment for setting **CO_2 emission standards for heavy duty vehicles.** The project has been carried out by a consortium consisting of TNO, TU Graz, CE Delft and ICCT under the Framework Contract no CLIMA.C.2./FRA/2013/0007. The objectives of SR9 are:

1. To provide provisional baseline fuel consumption values covering HDV groups above 7.5 tons, assessing these fuel consumption values for the relevant mission profiles.

2. To provide an assessment of the technical and cost-effective potential of measures to reduce fuel consumption and CO_2 emissions from HDVs.

3. To provide an assessment of social and economic impacts of various policy options regarding CO_2 standards, based on the Commission's guideline for impact assessments.

Step 1: was to determine baseline fuel consumption and CO_2 emission figures for different types of heavy-duty vehicles in the European fleet. Such baseline data serve as a reference against which reduction potentials can be assessed and as a baseline for setting target values.

Step 2: CO_2 emission reduction potentials of single technologies as well as combined technologies were elaborated. The potentials of the single technologies are input to the cost curves, while the simulation of technology combinations was mainly done to check if interactions between technologies exist and change the potential of the single technologies when combined with other technologies. A positive example is the CO_2 reduction from hybridisation, which showed higher reductions when combined with reduced air and rolling resistance.
To be able to calculate overall CO_2 abatement potentials from the existing technologies, it was planned to establish correction functions for such interactions. Some interactions were already considered in the design of the single technology data (e.g. the hybrid potential was simulated with an optimised 2025 HDV design as baseline and not for the 2016 baseline vehicle configuration).

Methodology

For all technologies that can be simulated with VECTO, the effects of the single technology were introduced into the VECTO input data of the baseline vehicle (e.g. a reduction of the CdxA value by xy%). Then Then the fuel consumption over relevant mission profiles has been calculated with VECTO for this input data set. The reduction potential of a technology is then calculated as ratio of the CO_2 emissions with the technology to the CO_2 emissions of the baseline vehicle.

For hybrid and for ADAS (Advanced Driver Assistant Systems) VECTO does not simulate the fuel consumption reduction. Therefore, for hybridisation the model PHEM from TUG was used instead of VECTO to calculate the CO_2 reduction for each HDV group, mission profile and payload condition. As with VECTO, the baseline vehicle and the hybrid vehicle were simulated and the relative change in CO_2 emissions are used to define the reduction potential. Since hybrids have a higher potential with lower air and rolling resistance due to the higher brake energy recuperation possible at such vehicles, the hybrid drive train was also implemented in an optimised 2025 vehicle version in PHEM.

The potential from ADAS technology (engine start-stop, eco-roll and predictive cruise control in its possible combinations) could not be simulated with available software tools. The reduction potential for these driver assistance systems therefore were calculated by VECTO modal result files.

This method gives CO_2 reduction values in line with the future CO_2 certification. In contrary, using CO_2 reduction potentials directly from literature implies the risk that the data in the literature was produced for other driving conditions (cycle, loading, gear shifts, etc.) than the standard VECTO conditions and thus may state quite different reduction potentials than one would get from a VECTO calculation. The outputs from the project fed into a set of recommendations over technology adoption measures for the reduction of CO_2 measures with overland transportation and logistics (table.2).

Table 2 - TR9 project technology recommendations for emissions reduction in overland logistics

Tech ID	Technology	FC reduction to Baseline group 5[%]				
		LongHaul low load	LongHaul representative load	Regional Delivery low load	Regional Delivery representative load	Weighted potential
Aux-6.1	Standard electric system with best performing alternator	-0.19%	-0.14%	-0.18%	-0.08%	-0.15%
Aux-6.2	LED electric system with best performing alternator	-0.25%	-0.18%	-0.25%	-0.13%	-0.20%
Trans-1	Reduced drivetrain losses (lubricants, design)	-1.43%	-1.52%	-1.64%	-1.77%	-1.52%
ADAS-1	Engine stop-start	-0.12%	-0.09%	-1.35%	-1.07%	-0.20%
ADAS-2-1	Eco-roll (w/o PPC, w/o ESS)	-0.53%	-0.50%	-0.74%	-0.28%	-0.50%
ADAS-2-2	Eco-roll (w/o PPC, w/ ESS)	-1.06%	-1.06%	-2.79%	-1.88%	-1.17%
ADAS-3-1	PCC (w/o Eco-roll, w/o ESS)	-0.43%	-1.38%	-0.73%	-1.90%	-1.14%
ADAS-3-2	PCC (w/ Eco-roll, w/o ESS)	-0.99%	-1.94%	-1.61%	-2.42%	-1.70%
ADAS-3-3	PCC (w/ Eco-roll, w/ ESS)	-1.50%	-2.46%	-3.57%	-3.87%	-2.33%
ADAS-5	Speed limiter 80km/h	-3.36%	-2.61%	-2.06%	-1.68%	-2.73%
Engine-1	Package 1: Improved turbocharging and EGR	-4.00%	-4.00%	-4.00%	-4.00%	-4.00%
Engine-2	Package 2: improved SCR and optimised SCR heating methods	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Engine-3	Package 3: Friction reduction + improved water and oil pumps	-1.97%	-1.46%	-1.80%	-1.40%	-1.60%
Engine-4	Package 4: Improved lubricants	-1.15%	-0.90%	-1.06%	-0.83%	-0.97%
Engine-5	Package 5: Waste heat recovery	-2.11%	-2.10%	-2.00%	-2.02%	-2.10%
Engine-6	Package 6: Downspeeding with optimised map	-1.24%	-0.37%	-1.30%	-0.83%	-0.67%
Hybrid-1	Mild Hybrid 48V (typical vehicle)	-0.44%	-0.43%	-1.24%	-1.15%	-0.51%
Hybrid-2	Full Hybrid typical vehicle 80kW electric motor continuous power/6kWh Battery capacity nominal	-0.47%	-1.98%	-5.47%	-5.87%	-1.95%
Hybrid-3	Full Hybrid best vehicle (current legislation) 80kW electric motor continuous power/6kWh Battery capacity nominal	-3.19%	-4.02%	-7.53%	-7.77%	-4.16%

Corealis – port of the future

COREALIS (www.corealis.eu) is developing an innovative framework for assisting cargo ports in handling their upcoming and future capacity, traffic, efficiency and environmental challenges. It is benefitting from disruptive technologies, including Internet of Things (IoT), data analytics, next generation traffic management and emerging 5G networks.

COREALIS is implementing beyond state of the art, financially viable innovations for future ports. These will optimise the port land use, requiring minimum infrastructure upgrades, while at the same time respect circular economy principles and improve the urban life quality. The innovations will be implemented and tested in real operating conditions in 5 Living Labs (Piraeus, Valencia, Antwerp, Livorno and Haminakotka port) and are briefly named below:

• The COREALIS Green Truck Initiative that comprises a dynamic Truck Appointment System.

• The COREALIS PORTMOD aiming to increase operational efficiency, safety for personnel, emission analysis and improved data sharing by modelling and optimizing cargo and data flows within a port.

• The COREALIS RTPORT that implements a system for real time control of port operations over a 5G network.

• The COREALIS Predictor for a dynamic and optimized port asset management. The COREALIS Cargo Flow Optimizer, aiming to facilitate the port managers and urban planners in their infrastructure investment planning by optimizing cargo flows across all transport modes.

Examples logistics ICT for Carbon reduction

The COREALIS Port of the Future Serious Game aiming to assess the feasibility and sustainability of the socio-economic and environmental development of a port within the surrounding coastal and urban area.

The COREALIS Green Cookbook aiming to help ports to lower their environmental footprint, assess their energy profiles and move to cleaner transport modes and cleaner energy sources. The COREALIS Innovation Incubator Scheme aiming at making the port the epicentre of the local industrial landscape and support the growth of local entrepreneur SMEs and startups.
Through its adoption of ITS solutions that are integrated, the project has impacted on ports of the future by:
1. Embracing circular models of strategic port design,
2. Improving operational efficiency and optimization of logistics flows,
3. Reduce ports carbon footprint and surrounding environment,
4. Developed innovation of local urban spaces.

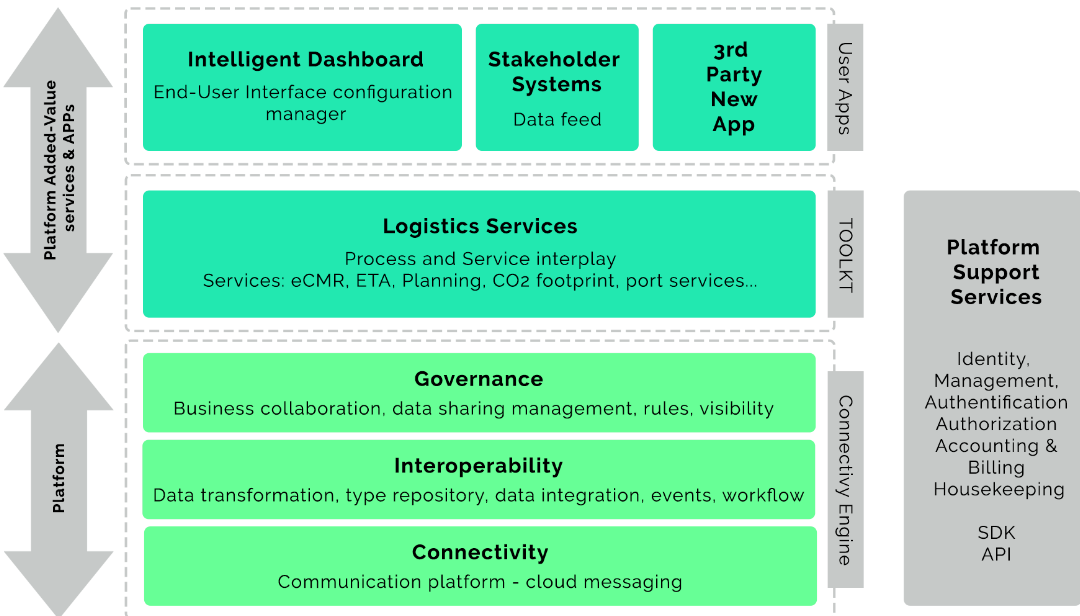
Designing and setting up a pervasive 5G network in a CT.

AEOLIX – connected ICT logistics architecture

The goal of AEOLIX is to overcome today's fragmentation and lack of connectivity around ICT-based systems for logistics decision making. Despite the recent investments in ERP, TMS and Port community systems, information gaps remain due to the disparate and passive nature of data. Each logistics player is currently required to log into each system separately to look for information or manually insert data into different formats.
AEOLIX is developing a cloud-based, multi-enterprise "many-to-many" network which captures and streams data in real-time, and automatically translates "data format" from different IT systems giving companies the ability to rapidly respond to issues through a customised dashboard.
The AEOLIX network enhances end-to end visibility across the supply chain supporting the workflow across companies/authorities.

Examples logistics ICT for Carbon reduction

It facilitates the automation of data flow and the interaction with the legacy systems and interoperability in line with standards and EU policy rules. AEOLIX also provides extra services that support monitoring of carbon footprint of logistics operations, estimated time of arrival at hubs or terminals, customs related services, electronic transport documents. These services further result in reduced delays, costs, and enable optimal load factors for shippers and transport operators.



Examples logistics ICT for Carbon reduction

AEOLIX provides a comprehensive architecture to enable a digitally secure and regulated logistics services and information sharing platform based on the following specific components:

- AEOLIX Dashboard : is an intelligent, user configurable web application that serves as a dedicated portal to the AEOLIX Platform, managing and enabling access to end to end logistics visibility through the data being shared by logistics partners via the CE. It enables intelligence to be added to the data from within the dashboard and by accessing and mobilising applications from the toolkit.
- AEOLIX Toolkit : comprises core logistics services to support and implement the business needs of AEOLIX end-users. Examples of services to be offered in the toolkit are: E-CMR, routing, planning services for road and intermodal service, ETA service, CO2 monitoring, dangerous goods transport management… Toolkit services can be used via the AEOLIX connectivity engine by applications, services and sensors or interplay with other toolkit elements.
- AEOLIX Connectivity Engine: responsible for providing the connectivity and interoperability services to support seamless data exchanges between organisations and services.These technical services provide the architectural setup, (1) connecting the end-user with its many business partners and systems in their networks, (2) allows for interoperability and governance services, the information exchange between different systems, partner/system interactions along with data sharing management rules.

AEOLIX has demonstrated through its 12 living labs an ability to reduce carbon emissions in the region of 20%, by embracing connected digital exchange across supply chain actors.

OptiTruck

The automotive industry has made a substantial effort in recent years to develop powertrain technologies to improve the fuel efficiency of Heavy-Duty Vehicles (HDVs). However, due to increasing road freight traffic, projections indicate that total HDV energy use and CO_2 emissions are expected to remain stable at the current level over the long term, if no policy action is taken. This is clearly incompatible with the goal of reducing greenhouse gas emissions from transport by around 60% below 1990 levels by 2050.

Source: www.optitruck.eu

Examples logistics ICT for Carbon reduction

The goal of optiTruck is to bring together the most advanced technologies from powertrain control and intelligent transport systems in order to achieve a global optimum for consumption of fuel (at least 20% reduction) as well as other energy sources and consumables while achieving Euro VI emission standards for heavy duty road haulage (40t).

Develop demonstrators to be tested in real environment: i.e. trucks equipped with real-time emission monitoring connected together with other sensors or data sources to the powertrain control unit of the truck for further processing (data fusion/predictive module) (to be on-line with Euro VI).

Optitruck's key objectives:

- Develop predictive intelligent modules based on predictive navigation and other environmental data.
- Develop software for the fusion and the optimisation of engine calibration mapping and powertrain control.
- Carry out real-environment trials with two demonstrators...
    a. One truck equipped with the current state-of-the-art techniques to collect the consumptions of fuel and other consumables to be used as the baseline data;
    b. One truck equipped with the proposed system to demonstrate on real road the reduction of fuel and emissions under different transport missions.
- Undertake validation and impact assessment to show the minimum 20% fuel reduction.
- Develop strategies for larger deployment of the proposed system within and beyond the project.

The optiTruck project will develop an intelligent and predictive powertrain control system. The system will utilise the information provided by new generation navigation systems and big data analytics such as predictive traffic and weather conditions, road topography and road network and information about transport mission to develop a strategy for the best route and the best velocity profile for fuel consumption optimisation. The developed strategy will be optimised dynamically in real road conditions in real time using the dynamic traffic and weather information and surrounding vehicle information. The global optimiser, using a predictive model based control system will realise a minimum of 20% fuel consumption reduction while optimising also the consumption of other consumables related to emission control on a typical transport mission without exceeding EURO VI emission level.

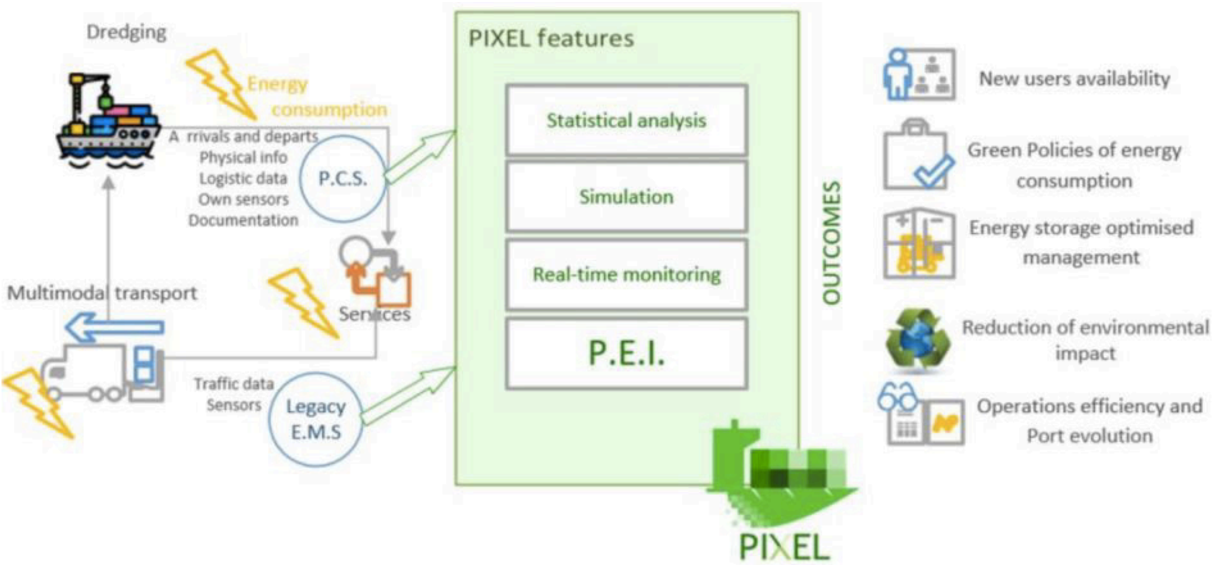
PIXEL

PIXEL is the first smart, flexible and scalable solution for reducing environmental impacts while enabling the optimization of operations in port ecosystems through IoT (Internet of Things).

PIXEL enables a two-way collaboration of ports, multimodal transport agents and cities for optimal use of internal and external resources, sustainable economic growth and environmental impact mitigation, towards the Ports of the Future. Built on top of the state-of-the art interoperability technologies, PIXEL centralises data from the different information silos where internal and external stakeholders store their operational information. PIXEL leverages an IoT based communication infrastructure to voluntarily exchange data among ports and stakeholders to achieve an efficient use of resources in ports.

PIXEL (Port IoT for environmental leverage) aims at creating the first smart, flexible and scalable solution reducing the environmental impact while enabling optimization of operations in port ecosystems. This approach relies on the most innovative ICT technology for ports building upon an interoperable open IoT platform. PIXEL use-cases are also presented in this paper, aiming to demonstrate, through various analytic services, a valid architecture drawing from heterogeneous data collection, data handling under a common model, data storage and data visualization.
Besides that, PIXEL devotes to decouple port's size and its ability to deploy environmental impact mitigation specifying an innovative methodology and an integrated metric for the assessment of the overall environmental impact of ports.

Maritime ports concentrate, in direct link to their transport activities, logistics and industrial activities and interact with urban territories. PIXEL adheres to the principles of sustainable development, combining and balancing the requirements of environmental conservation, protection of individuals and economic development, and is in line with the EU's ambition: a secure, competitive and decarbonised transport and energy system in 2050, associated with the port of the future.



Framed in achieving this new port concept in a very efficient way, PIXEL aims at achieving these objectives :

- To meet local energy needs during the call of a ship in order to cope with renewable energy production the port must itself reduce its own carbon footprint.
- To create and deploy a Port Environmental Index (PEI) to measure the efficiency of a port's green policy, and of the supply chain connected to the port.
- To analyse major traffic long term trends thanks to deeper port statistics analysis.

Smart Freight Centre: Decarbonising Freight and Logistics Management

Problem

Freight transport and logistics currently contribute about 8-10% of total CO_2 emissions worldwide. At the current pace, logistics emissions will more than double by 2050, yet we need to reach almost zero emissions by 2050 to meet Paris climate goals. Freight and logistics is, however, not high enough on the sustainability agenda of government and business for substantial action to have started. Solutions already exist for many stakeholders, sectors, and countries that if implemented in a coordinated manner could reduce emissions by >80% by 2050.

Use of a consistent, recognized and tested approach to emissions calculation and reporting is needed alongside any meaningful attempt to implement emission reduction measures so that emission hotspots can be addressed, progress tracked and future interventions planned.

Access to good quality, preferably independently verified, data as an input to emission calculations on which to base logistics emission reduction decisions is a well-known challenge. Good work has been undertaken by green freight programs such as Clean Cargo, SmartWay and Green Freight Asia to highlight and address the issue, but these programs require proactive opt-in, and tend to be limited in application by mode or region. This lack of good data is exacerbated by the fragmented nature of the freight transport sector; a lack of knowledge on the part of many road freight operators stops companies including the full range of potential actions in their emission reduction strategies with any certainty or opportunity to monitor impacts. It also means that market demand for relevant IT solutions has not yet been recognized by solution providers.

Examples logistics ICT for Carbon reduction

Resources

Led by SFC, the Global Logistics Emissions Council (GLEC) was established in 2014 as a voluntary partnership and has grown to more than 50 companies, industry associations and green freight programs, backed by experts, governments and other stakeholders. Together, they have developed the GLEC Framework – the only globally-recognized method for harmonized calculation and reporting of emissions across the multi-modal logistics supply chain.

The GLEC Framework acknowledges the important role that the type of data has on the accuracy of results and hence the extent to which calculation results can be used to inform and track reduction actions.

The following categories are set out to clarify input data types:

- Primary data. Good quality primary (actual) data is what should be used by a transport or logistics site operator to calculate its Scope 1 carbon emissions, and what transport buyers should aim to collect from carriers for their Scope 3 emissions accounting.
- Primary data can range from highly precise information, such as from fuel receipts or annual spend, to aggregated values that reflect fuel or emission intensity for a year's worth of vehicle movements.
- Program data. Green freight programs play an important part in acting as a neutral platform to collect and share reliable data between transport operators and their customers in a neutral, managed environment. Program data can guide carrier selection and identify potential energy, cost and emission saving strategies.
- Modelled data. Companies and tool providers model fuel use and emissions using available information on goods types, consignment sizes, journey origin, destination and intermediate handling locations, and any information about the vehicles used, load factors, etc.
- The relevance of the model's outputs will depend on the level of detail that is available about the transport operation, the assumptions made, as well as the model's algorithms. In general, assumptions that are made that rely on default data, rather than primary data, will lower the validity of the output.
- It is important to ensure that the methods and default data embedded into tools align with the GLEC Framework.
- Default data. If no other data are available, the last resort is to use default data representative of average industry operating practices. Default data can provide a general indication of emissions, illuminating hotspots and offering a structure for prioritizing further data collection to improve accuracy. Communication with suppliers can help to better understand the actual conditions in order to pick the most appropriate default factors. Specific information about the vehicle fleet, fuel type, temperature control, topography, etc. can improve accuracy.

It is important to remember that primary and modelled data are much more likely to be representative of actual conditions than default data. One of the main challenges in the calculation and reporting of emissions from logistics activities is the complex nature of the relationships between the various stakeholders involved. This is reflected in strong differences in natural data visibility to the carrier, logistics service provider (if there is one), and shipper.

The result is often incomplete data availability to any one organization that is trying to perform a calculation that leads in turn to the need to address at least three related questions:

- Who should have responsibility for calculating and reporting what level of emissions information ?
- What is needed to collect the necessary information ?
- What mechanisms might facilitate the necessary data transfer?

The challenge caused by the common (but not universal) separation of the roles of owner of the goods, organization of the transport and operation of the transport, which lies at the heart of the data sharing question is not unique to emissions accounting and reporting. This led us to consider the existing arrangements used in other aspects of logistics data

[1] - Contributor : Alan Lewis, Technical Development Director, Smart Freight Centre
[2] - International Transport Forum (ITF). ITF Transport Outlook 2019

transfer. The Logistics Interoperability Model (LIM) developed by GS1 contains a number of definitions that potentially help clarify the approach to be taken in terms of where responsibility should rest for calculating and reporting and for some of the mechanisms that might help facilitate data transfer.

In particular the LIM clarifies two scenarios where :

1. The shipper of the goods prepares the goods for transportation.
2. The transporter prepares the goods for transportation.

The data requirement to calculate corporate emissions is a knowledge of the fuel used and the appropriate emission factor.

The perspective of the customer of transport services, who would report Scope 3 emissions from contracted transport services is somewhat different. Currently, their knowledge is often extremely limited because they have information at shipment level (origin, destination, shipment weight, transport mode, logistics unit and lead logistics provider), but do not know how this relates to the consignment and hence the necessary detail (e.g. fuel, distance, vehicle type, vehicle load level) to perform an accurate calculation themselves.

It is for this reason that, if they choose to take ownership of the calculation, they often resort to the use of either default intensity data. However, investigation of the data landscape is beginning to show that the data needed for a reasonably accurate calculation is more accessible that previously realized; development of modern IT systems and awareness of interoperability could soon allow access to a step change in accessibility of good quality GHG emission results from commercial TMS systems, so providing customers with a step change in understanding of their logistics climate impact.

Approach

There are many variations of the software system available to transport operators, LSPs and shippers, both developed internally and available on the open market. The scope of these data management systems naturally reflects the role of the organization in the supply chain and the data that they generally have at their disposal.

Carrier systems tend to focus on vehicle operation aspects, including trip planning and routing, fuel management, load optimization, driver performance (safety and efficiency), traffic conditions and customer invoicing. These systems are increasingly including dynamic (real-time) functionality to track estimated time of arrival (ETA) vs schedule in case of risk of missing booked slots. Emissions are generally linked only to overall fuel use and a fuel / distance KPI (i.e. litres per 100 km or miles per gallon).

Shipper systems tend to focus on more commercial aspects related to the shipment, its origin and destination and the parameters that the transport operator needs to abide by. Where the shipper has tight control of the transport specification, or direct control of the transport contract (i.e. no LSP as intermediary) then they may also have information on origin, destination and intermediate handling locations, routing, vehicle type and loading.

It is in these circumstances where the opportunity to tap directly into TMS data begins to offer a solution. 3rd party logistics service providers would have the same opportunity where they are the direct customer of contracted hauliers, although they have a significant challenge due to the sheer size and diversity of their transport networks.

In general terms the basic range of inputs needed to produce a generic calculation is fairly simple:

- Vehicle body type and size class
- Fuel type
- Amount of fuel used
- Load
- Loaded Distance
- Empty running

Examples logistics ICT for Carbon reduction

This has been tested as part of the EU-funded AEOLIX project, with one of the living labs allowing access for us to model the fuel use, total emissions and emission intensity of one-way loads providing ʻbased on the following data from the shipper TMS system:

- Vehicle body type and size class
- Fuel type
- Load
- Loaded Distance

The results present a comparison of energy and emissions efficiency between a control group of unconsolidated consignments arranged independently and a group of consignments where a proactive effort has been made using the AEOLIX platform to match loads to fill underutilized capacity and hence remove unnecessary journeys from the road. The results also show how the traditional measure of liters / 100km (or mpg), used by most companies is in itself a misleading KPI.

	Control Consignments	Consolidated Consignments
GHG intensity (kg CO2e/tkm)	116	66
Total emissions (t CO2e)	166.0	94.6
Savings (t CO2e)	-	71.4
Improvement in efficiency (%)	-	-43%
Traditional fuel economy (l/100km)	28.8	33.6

Analysis also shows that further improvements could be made. Without looking for further additional consignments to fill remaining unutilized capacity, but instead decreasing the vehicle size to match the consolidated consignments then a further 3% reduction to 92.1 t CO_2 would be possible.

In terms of making the calculation, there is flexibility in terms of what information to work with. The minimum inputs required are consignment weight, point of origin and destination and a freight-specific route planner. As you add knowledge of each of these other elements, below, the accuracy of the calculation outputs increases in a similar way as the previously described progression from default to primary data:

- Known vehicle type and size rather than generic,
- Known fuel type rather than assuming diesel,
- Known level of load, taking into account consolidation and co-loading possibilities,
- Known empty running rather than generic value,
- Known fuel used for each leg rather than calculated based on the other inputs.

The final step of bringing in actual fuel use rather than estimation could have been possible for some time already via open access to the remote monitoring systems offered by vehicle manufacturers. However, an alternative is now available, also developed and tested with the help of the AEOLIX project: T-Systems has taken steps to progress a proposal for an ISO standard to calculate CO_2 values and indices based on vehicle trip data. The trip data are defined as position data, speed, time that can be tracked via a mobile phone app, and combined with vehicle data like mass, roll friction etc. then the service can calculate, via defined physical formulas, an estimation of fuel consumption and a directly related CO_2 value. This proposal has been sent to the ISO balloting system as a New Work Item Proposal. The ballot was launched in June 12th 2019 and the result should be known by the time of the conference.

Conclusions

Online platforms can be used to improve freight transport efficiency by better matching loads to available capacity.
It is possible to use relatively basic information, needed by the platform to match the loads and vehicles, to also produce indicative calculations of GHG emissions. This type of approach would take the pressure off road transport carriers, who often lack the in-house knowledge, to spend resources on proactively reporting data to their customers. This has the potential to remove one of the current barriers to access to GHG data.
The above estimations could be improved by phone-based apps that track vehicle position and dynamics to improve the accuracy of the calculation outputs.
It is our intention to work with interested TMS providers and shippers, LSPs and carriers from within the GLEC membership, to address the barriers that currently prevent access to reliable GHG emission data. Through a harmonized approach to collection of the necessary data we will focus on adding significant visibility for meaningful road freight KPIs, looking to significantly increase the extent of practical implementation in commercial transport management systems and national energy and emission reporting systems.

Acknowledgements :

EC via LEARN & AEOLIX projects
GS1
GLEC membership
T-Systems

Examples logistics ICT for Carbon reduction

Carbon-free trucks

Although alternative energy for trucks is not strictly within our theme of ITS and smart mobility tools, it is perhaps the elephant in the room. Because while there is already a fast-growing market and infrastructure for electric cars and their charging points, battery technology is not yet able to power heavy trucks over the long distances that are the norm in Europe.

A recent study on Future Fuel for Road Freight commissioned by Fondation Tuck[4] concluded that (overhead) catenary electric trucks (CEV) or trucks powered by hydrogen fuel cells (FCEV) could be truly zero-emission, provided the original source of energy was itself zero-emission, e.g. fully renewable electricity.

CEV rollout would require dedicated overhead power catenary infrastructure, likely to be limited to dedicated high-volume corridors. FCEV deployment would require wide coverage of H2 fuelling stations, but then equipped vehicles could travel anywhere within that range. For both technologies, the technology exists at pilot or limited production scales, but is not yet economic or fully mature.

Finally, due to the limitations on energy infrastructure of both technologies, the support of ITS and smart mobility services would be essential for drivers, transporters, shippers and other logistics partners, e.g. for guidance to and booking of hydrogen refuelling points, or to help CEV users connect to the overhead electricity supply.

[4] - Patrick Schmidt, Werner Weindorf, Tetyana Raksha, Reinhold Wurster (LBST), Henri Bittel, Jean-Christophe Lanoix (Hinicio): Future Fuel for Road Freight –Techno-Economic & Environmental Performance Comparison of GHG-Neutral Fuels & Drivetrains for Heavy-Duty Trucks; An expertise for Fondation Tuck, Munich / Brussels / Paris, February 2019

Conclusions and Recommendations

Climate adaptation and mitigation for the logistics and supply chain sector poses complex challenges for policy makers, business actors and civil society due to perceived and real trade-offs between upfront costs and longer-term benefits. This sector will also be indirectly affected by the adaptation and decarbonisation of the other sectors that it serves. There is no doubt that policies aimed at meeting the agreed target of keeping global warming since pre-industrial times below 2°C would have major implications for all elements of the transport sector in the short and medium term. Despite a lack of significant and consistent progress, AR5 concludes that the emission reduction potential in the transport sector is larger, and comes at lower cost, than stated in its previous assessment in 2007. There are positive indications that pricing and other stringent policy options are in some places being implemented alongside new technologies.

There are signs that :

- Light-duty vehicle ownership has peaked in some OECD countries,
- Uptake of electric vehicles and mass transit systems has increased,
- There is renewed interest in compressed and liquefied natural gas and in biofuels,
- There is greater awareness of the co-benefits of urban planning that promotes walking and cycling.

If a collective commitment to redesigning low-carbon transport systems and demand management can be harnessed, there are major opportunities to implement ambitious mitigation measures that enhance the adaptive capacity of the industry as well as enable the realisation of significant co-benefits to society. Given an expected doubling in the global urban area this century – and the fact that most of the world's urban space is not yet built – recognition of opportunities to make sustainable urban transport planning decisions at the outset of new developments must be prioritised, in order to create resilient, climate-smart cities. Such decisions can build in resilience to projected climate impacts such as sea-level rise, flooding and extreme weather. Inside and outside urban centres, increasingly serious climate impacts will create an ongoing need for adaptation to changed conditions, which implies additional investment.

For companies, there is a need to develop strategies for efficiency, modal shift and acceleration of the development and deployment of low-carbon fuels/vehicles in global logistics networks. These strategies will entail new partnerships with government and civil society as well as collaboration with industry peers and customers to advance policy solutions and identify funding mechanisms that can bridge the gap between up-front capital requirements and longer-term benefits.

As in other domains, the necessary reductions in GHG emissions can only be achieved through a deeper collaboration amongst the wide range of actors involved in generating demand for, carrying out and catering for goods transport.

At least this includes :

- vehicle manufacturers
- energy suppliers
- road operators and traffic managers
- manufacturers
- logistics providers
- fleet operators
- retailers
- urban distribution and delivery services
- service providers
- ports
- rail freight and intermodal operators
- etc. etc.

ITS4 Climate aims to bring these together around the common mission to cut CO_2 emissions drastically, in a short time, using the full armoury of tools and measures of ITS, smart mobility and smart logistics.

Authors

Liam FASSAM,
Directeur LIST Institutes, Université de Northampton - United Kingdom

Thought leader, Researcher & Implementer of collaborative logistics and supply chain social value solutions, with over 29 years Supply Chain Senior Leadership experience. Engaged as University Head of Research for Logistics, Supply Chain and Transportation, strategically leading impactful research allied to social impacts on societies connection to food logistics and supply chain resilience. In addition, am Director and founding partner of a Transformational Social Enterprise University spin out business tasked with building social value through logistics and transportation networks. Research expertise validated through numerous European Commission projects, such as seventh framework project (FP7-SME-2011) delivering subject matter expertise in UK and European rail/road intermodal markets, Horizon 2020 programs TinnGo (Women in transport), MG4.1 [AEOLIX] (Global logistics connectivity & ICT), MG4.4 [SPICE] (Public sector transportation policy) and IND CE 2017 [PolyCE] (Resource efficient circular economy supply chains) alongside UK Government research with the Department for Transport on Smart city transportation and the Government Office of Science delivering intelligence around freight and transportation futures (GO Science). Also engaged as expert adviser to Seafish (DEFRA) on food supply chain resilience, All Party Sustainable Resource Group in the areas of Supply chain and Food security (APSRG), and Office of the Government Chief Scientific Adviser around freight futures. Am a Fellow of the Royal Geographic Society and appointed to the advisory boards of the Local Government Authority logistics strategy group, Non-Exec Director for SOCIETAL Value CIC, and twice awarded Global social media Influencer in the field of Supply Chain Management.

Olivier QUOY,
CEO, Atlandes

Graduate of Ecole Polytechnique and Ecole Nationale des Ponts et Chaussées, I have worked for the french department of transport on various positions in charge of infrastructure project (in Besançon, Strasbourg and Paris) until 2015 when I joined Atlandes.
In Besançon I dealt with urban politics, european funds and infrastructure development.
I moved to Strasbourg to set up for the french railways (SNCF) the Agency in charge of station renewal and enlargement for the new high speed line Paris-Strasbourg, in 2001-2002. I then came back to the Ministry, in charge of funding and planning of housing and infrastructure projects for the Alsace area. I carried General Interest procedures for the Strasbourg Great Western Bypass, combining consultation needs, environmental and technical issues. I joined the national HGV charging scheme project in 2007. I led local road network and enforcement system definition, economic appraisal studies and competitive dialog. I followed the building on the ground and revised revenue and charge forecasts for the State. I organised and participated to the first ground tests in Alsace in April 2013. In charge of contract termination when project was dropped, I joined Atlandes in 2015 when things were settled. As CEO of Atlandes, I launched innovative programs among which real-time display of truck parking availability, testing « Wattway » solar road and promoting « Prudensee » connected glasses to detect drowsiness.

Authors

Alan LEWIS,
Technical Develpment Director, Smart Freight Centre

Alan Lewis is Technical Development Director at Smart Freight Centre. As such he has responsible for the overall development of SFC's program of initiatives that are developed under the overall banner of the Smart Freight Leadership Framework. The first of the component guidelines is the GLEC Framework for Logistics Emissions Methodologies; Alan has led the development of the Global Logistics Emissions Council (GLEC) for SFC, since its inception in 2014. The GLEC is a global, industry-led partnership that is successfully harmonizing methods for carbon footprinting of freight transport across modes and global regions.
Alan has 25 years of experience of working on sustainable transport projects, working with UK consulting firms TTR and AEA Technology, particularly relating to the emissions impacts of urban transport and freight activities. He was part of the team which established the UK Transport Energy Best Practice Programme which evolved into the successful Freight Best Practice Programme, co-ordinated the South London Freight Quality Partnership for 6 years and was in charge of the networking and outreach activities of the European COFRET project. He was also heavily involved in several projects as part of the EC's CIVITAS programme. He has a PhD in Materials Science from Cambridge University.

Michel LE VAN KIEM,
Head of Development, Marketing and Innovation,,
Grand Port Maritime de Bordeaux

"In charge of the development, marketing and innovation of the port of Bordeaux, I am responsible for defining strategies, in a short term vision, but also in a long term vision. In this context, adapting the port to climate change and to energy transition will be crucial for its future prospects. The decarbonisation of transport is obviously a subject to develop in different aspects: alternative fuels, logistics optimization logistics, fluidification of administrative burdens... The use of new technologies such as IoT will strengthen the capacity of supply chain actors to optimize the efficiency of transport means."

Charles GARNIER,
PhD, Research Engineer, CATIE

Charles Garnier have a PhD in Fluid Mechanics and he is currently research engineer at CATIE. He is project manager on the H2020 PIXEL project (www.pixel-ports.eu) for CATIE. The aim of the PIXEL project is to help the digital transformation of ports in order to minimize the environmental impacts of their activities. In this project, Charles also assumes coordination and management of the work package dedicated to modeling and data analysis of port activities.

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